

Recent Results on SNRs and PWNe from the Fermi Large Area Telescope

*Elizabeth Hays
(NASA/GSFC)
On behalf of the Fermi LAT Collaboration*

Fermi LAT Collaboration

France

- CEA/CEA-Saclay

Italy

- INFN, ASI, INAF

Japan

- Hiroshima University
- ISAS/JAXA
- RIKEN
- Tokyo Institute of Technology

Sweden

- Royal Institute of Technology (KTH)
- Stockholm University

United States

- Stanford University (SLAC and HEPL/Physics)
- University of California at Santa Cruz - Santa Cruz Institute for Particle Physics
- Stanford Space Flight Center
- Naval Research Laboratory
- Sonoma State University
- Ohio State University
- University of Washington

Principal Investigator:
Peter Michelson (Stanford University)

390 Scientific Members (including 96 Affiliated Scientists, plus 68 Postdocs and 105 Students)

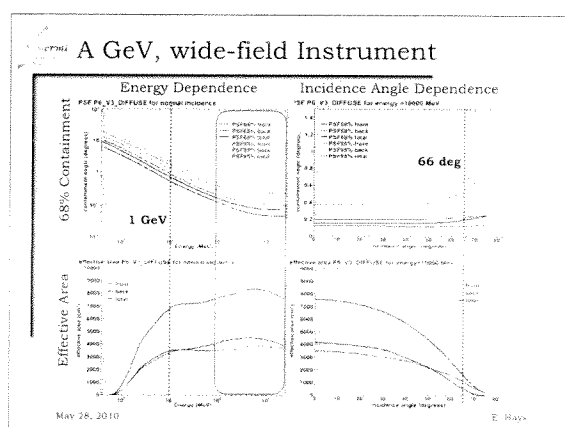
Managed at SLAC

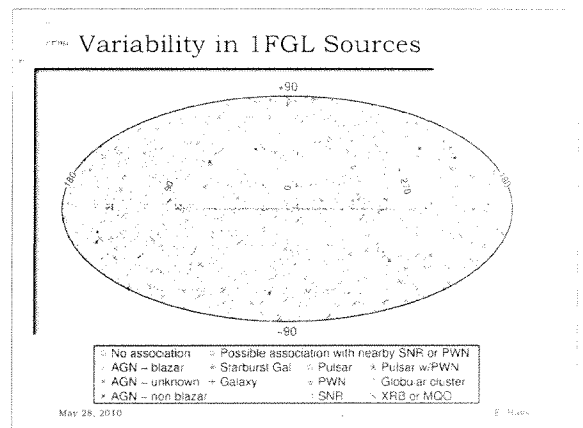
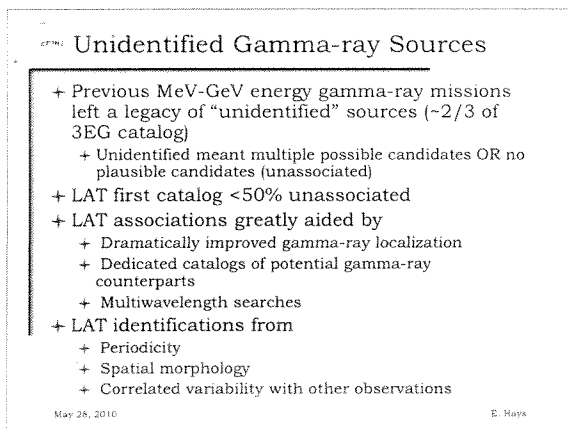
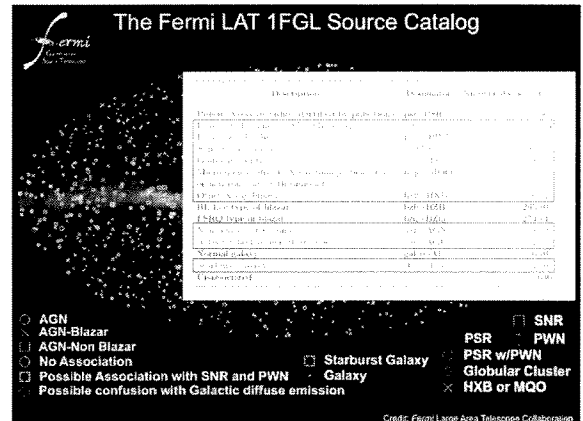
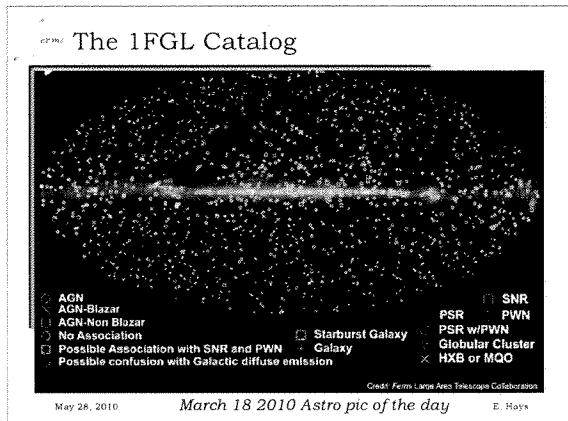
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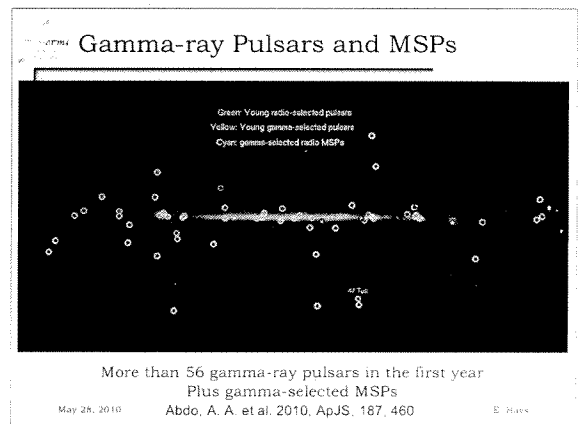
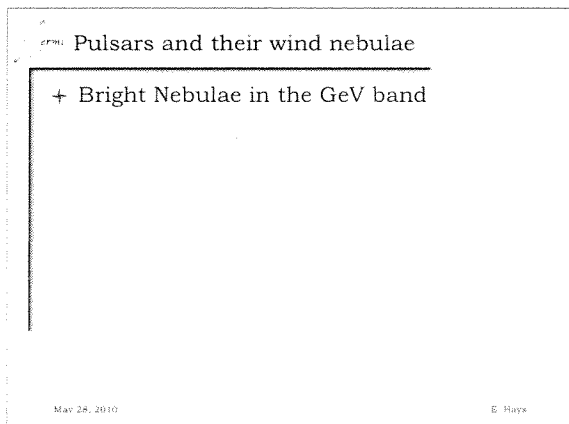
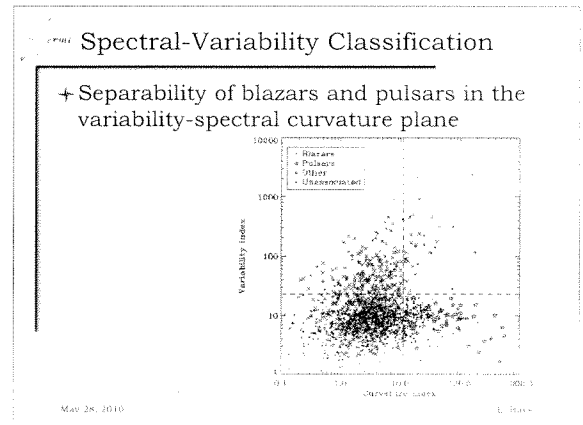
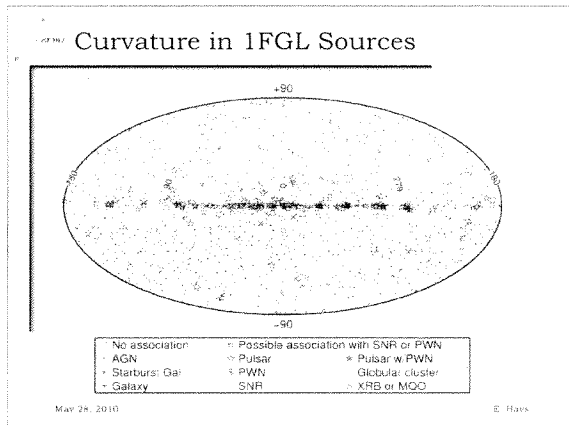
Galactic Results from LAT

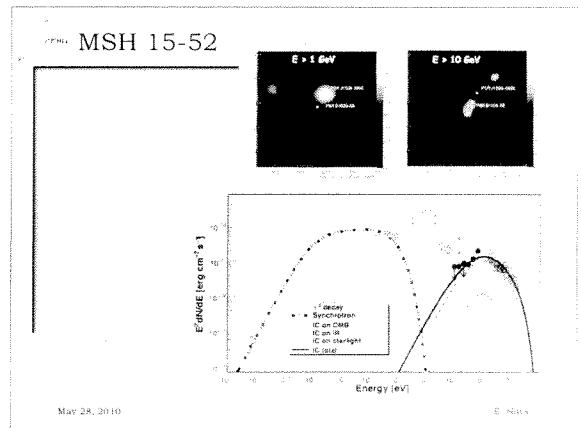
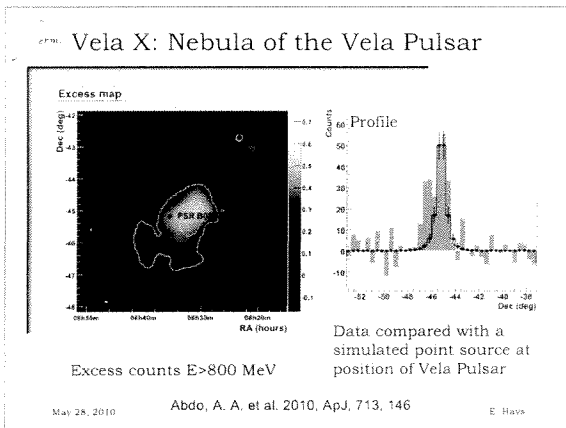
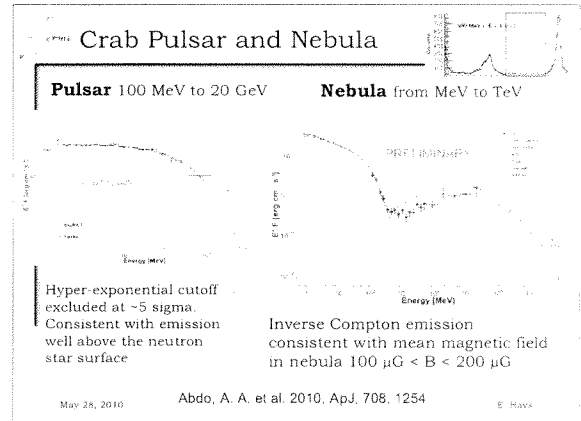
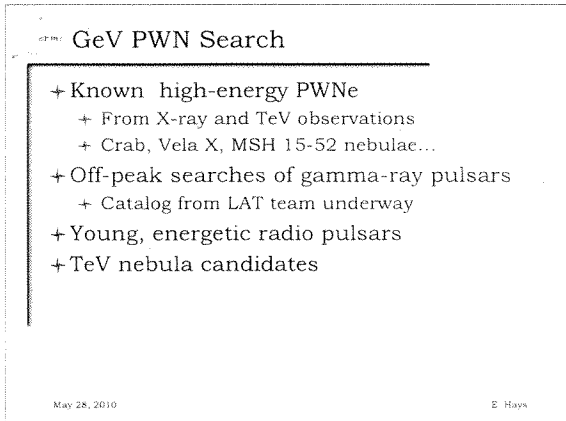
- + 1FGL Galactic populations
 - + The seen, the unseen, and the unknown
- + Selected Highlights
 - + Pulsars
 - + Pulsar Wind Nebulae
 - + Supernova Remnants
 - + Transients
- + Future Prospects

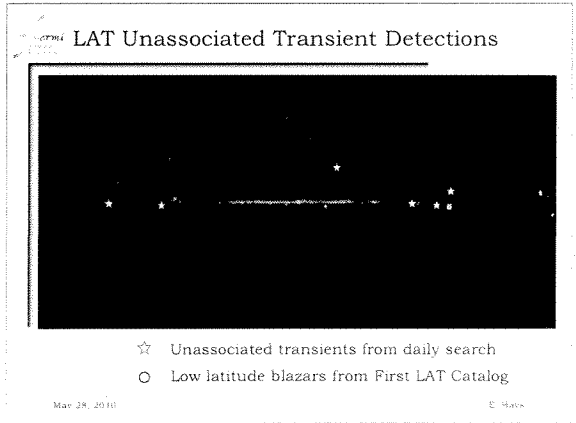
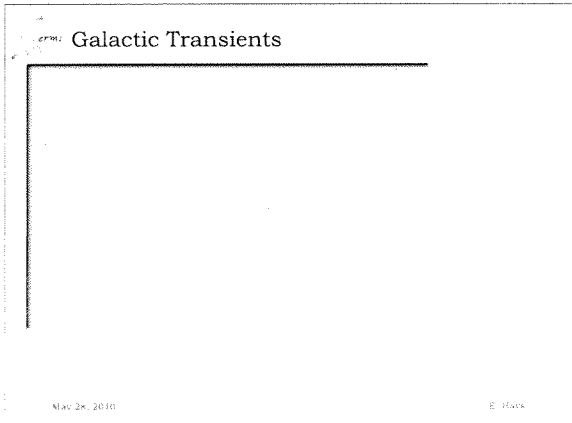
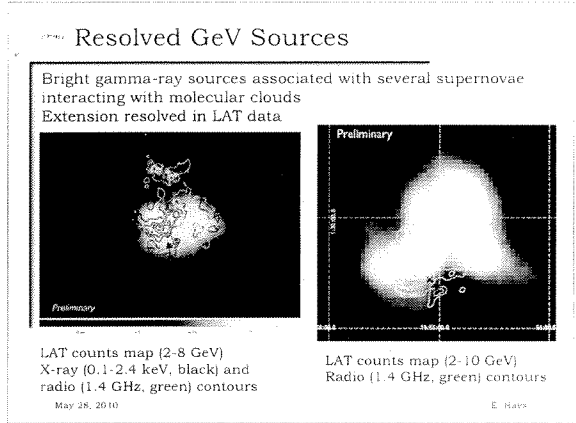
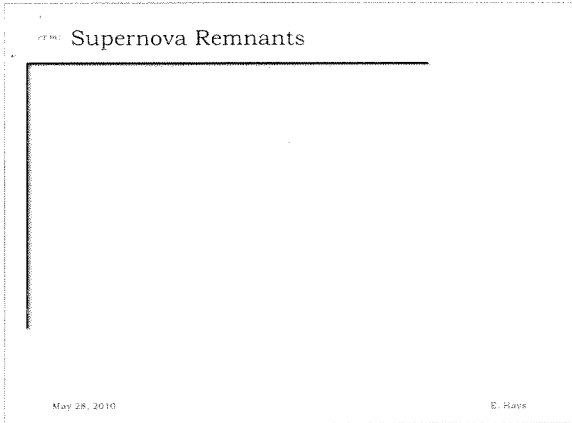
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Gamma rays from a Nova

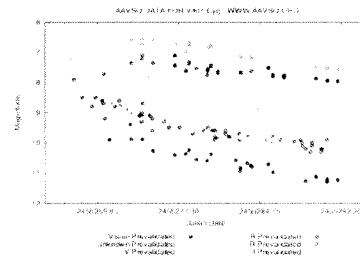
- + Fermi J2102+4542
- + Located in the direction of the Cygnus region
- + Bright, high confidence, detected over several days by automated processing
- + No likely blazars in error circle...

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V 407 Cygni - a symbiotic nova

- + Position and timing consistent with V 407 Cygni, a recurrent nova detected in outburst ~2 days before the Fermi report



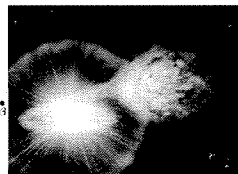
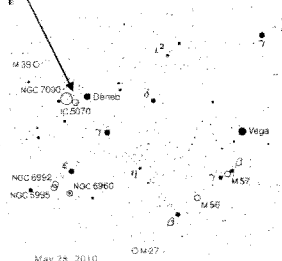
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V407 Cygni: a variable star

Symbiotic binary:
White dwarf star and red giant star orbiting each other

Near Deneb in Cygnus



Variability from
- Mira variable star
- White dwarf accretion
- Binary interaction
A complex and fascinating system!

V407 Cyg ~ 6000 light years away

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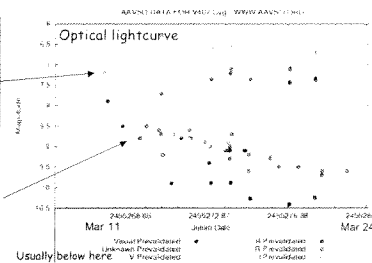
March 11 - A Nova!

Hydrogen accreting on to the surface of the white dwarf ignites a nuclear explosion (30-60 of these per year in Milky Way)

Candidate nova discovered by amateur astronomers, Nishiyama and Kobashima

Fermi detects a new gamma-ray source in the same field on March 13 (ATEL #2487)

Spectrum does not look typical - a **symbiotic recurrent nova**?
Very few systems explode on decade timescales (RS Ophiuchi ~20 yr period)



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Symbiotic Nova

- + Symbiotic Binary System: White dwarf + red giant system
- + Nova: White dwarf builds up mass envelope to the point of thermonuclear fusion
 - + Dramatic increase in visual magnitude
- + Recurrent Nova?
 - + Hints but no strong confirmation of previous nova
- + Pre-nova activity
 - + White dwarf shows ongoing variability at level of several in magnitude
 - + V407 Cyg companion is a Mira star showing variability at level of several in magnitude
 - + Dusty environment with stellar wind
- + Origin of the gamma rays?
 - + Strong shock propagating into dense medium around giant star (and stellar wind)
 - + Pion decay or electron processes? (brehmstrahlung)

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Summary

<http://fermi.gsfc.nasa.gov>

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Extras

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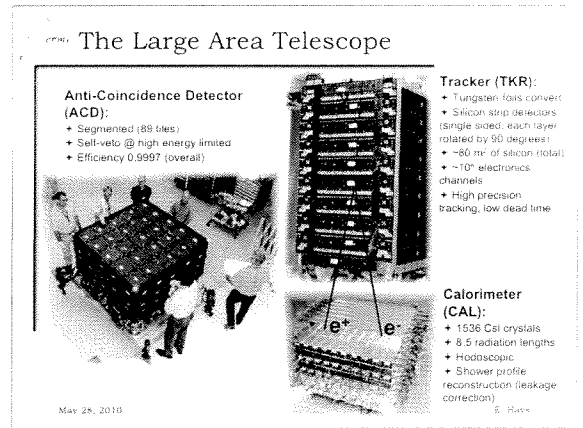
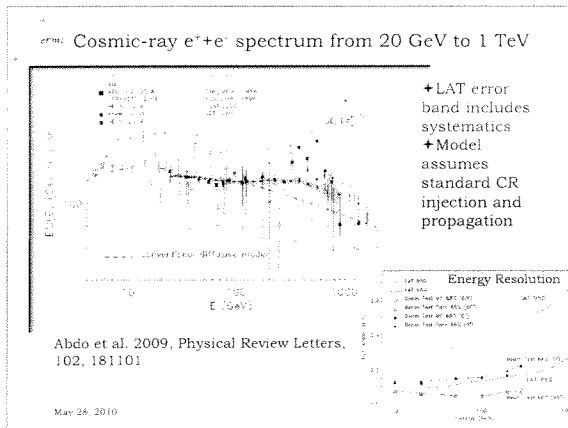
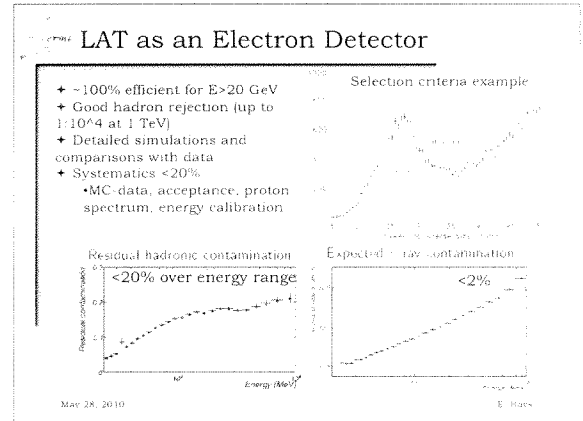
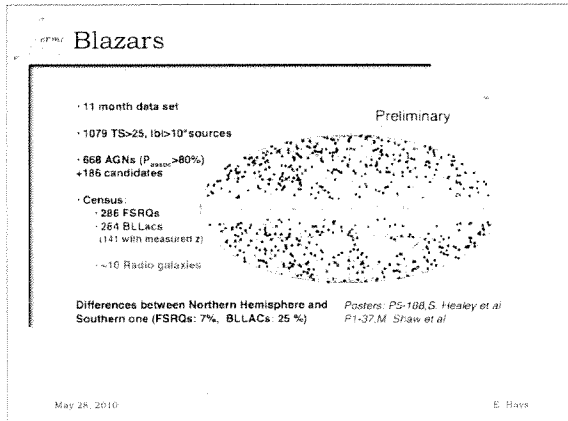
Pulsars everywhere...

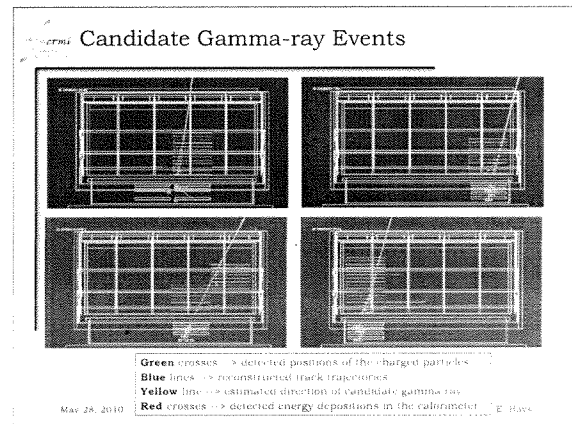
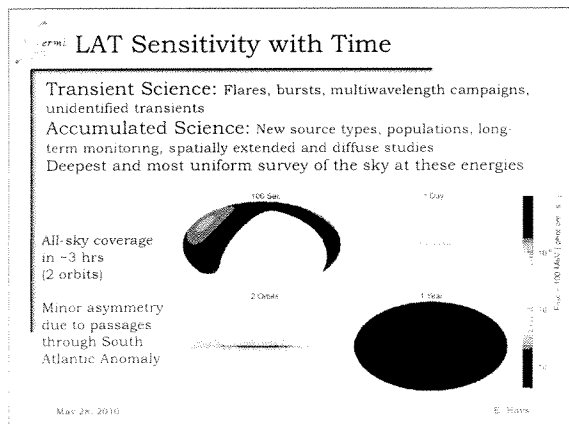
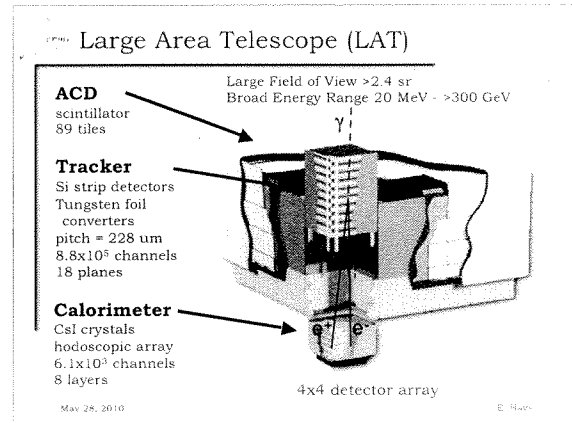
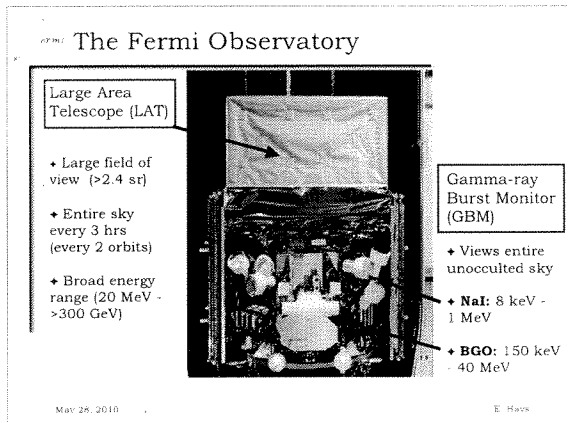
- + >50 gamma-ray pulsars so far
 - + >40 young, energetic pulsars
 - + 9 old, recycled millisecond pulsars
- + Identifying EGRET unidentifieds and LAT unidentifieds
- + Gamma-ray beam is bigger than radio beam
- + Pulsar spectra have exponential cutoffs in the GeV band
- + Gamma rays from outer magnetosphere preferred
- + Bonus: LAT unidentifieds also turning up new radio millisecond pulsars

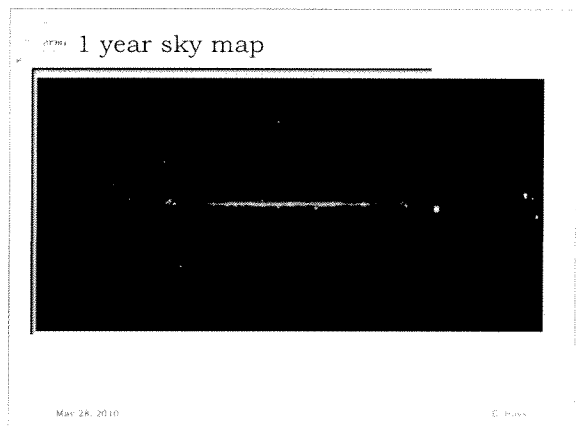
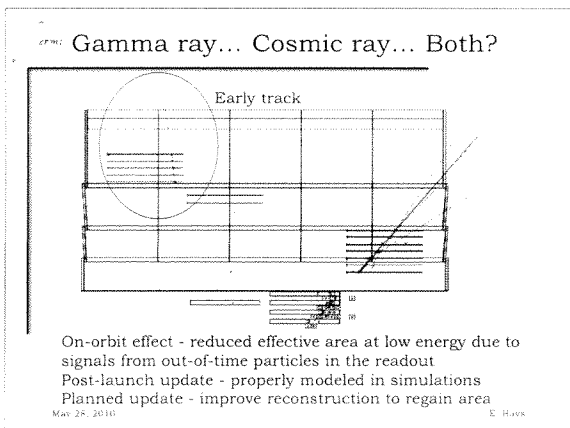
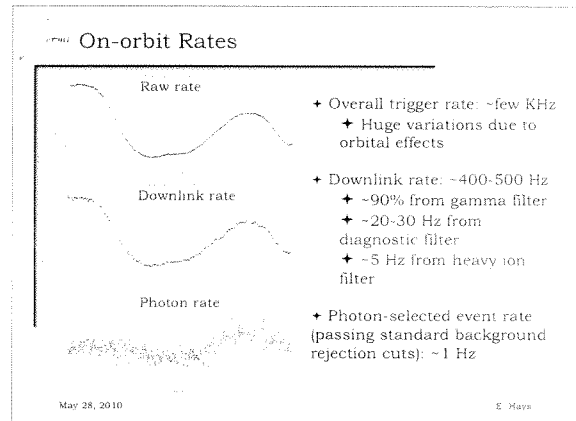
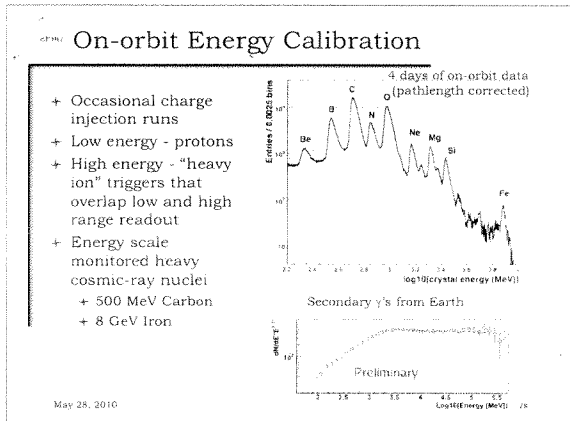


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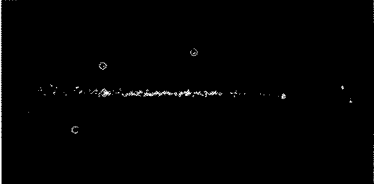




LAT Automated Science Processing

Automatic transient monitoring

All-sky search runs every 6 hours, 1 day, 1 week



Typical count map for 6 hours (E>100 MeV)

LAT flare advocates monitor results and trigger multiwavelength follow-up.
Reports at <http://fermisky.blogspot.com/>

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Reported GeV Flares

+ Astronomers Telegrams

+ >70 since July 2008

+ Associated blazars plus 6 initially unidentified transients

+ Fermi Gamma-ray Sky Blog

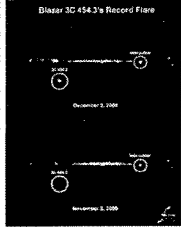
+ notes on daily and weekly source activity

+ <http://fermisky.blogspot.com>

Early Activity and Spectacular Flare

3C 454.3

Blazar 3C 454.3's Record Flare

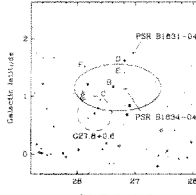


Photon flux of brightest persistent GeV source, Vela Pulsar (~1 γ every 2 min)

Gamma-ray Transients near the Galactic Plane

GRO J1838-04

EGRET observed 3.5 day flare near the Galactic Plane in June 1995



No blazar candidates found

